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Geophysical Significance of Rain Water Harvesting

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ABSTRACT

Water is a natural gift to all livings. It is the bone of our country. Water is found on the surface and under the surface. But due to over exploitation, the amount of water is decreasing very rapidly. As our country is developing, the availability of fresh water is decreasing rapidly. These problems force us for thinking, discussing and planning how to save and store water. Physicists, scientists, geologists and our governments are doing works to solve these problems. However some methods and techniques which help us to store water have been developed. Since India is a developing country so we should develop techniques and methods which are cheap and may be used by all people and governments. Thinking these in mind some methods and techniques are being described. Availability of water depends on rain fall. Water on surface and sub-surface can be recharged by storing rainfall. To store rainfall before being waste is called rain water harvesting. Rain water harvesting is only the method which is very cheap to recharge ground water as well as surface water. In this situation artificial recharge to ground water by collecting and storing rainfall is being developed.

KEYWORDS: Rainwater, Gully plug, Contour bund, Gabion structure.

INTRODUCTION :

There are mainly two sources which provide water to us. Water which is available on the surface is called surface water. Ponds, lakes, waterfall, rivers etc. are example of surface water. Water which is present under the ground is called ground water. Surface water is recharged directly by rainfall while underground water is recharged by surface water. Therefore it can be said that ground water is recharged indirectly by rainfall. Groundwater is found in aquifer. Aquifer is a type of rock which has a capacity to store water. Cracks and pores are found in aquifer where water is stored. Rocks which do not have cracks and pores cannot store water inside it. Hard rocks and clays are example of rocks which have a capacity to store no water ground water accupy more water than surface water.

METHODOLOGY :

We do different methods in urban area and rural area depending on their situations. In urban area, there is lack of soil surface. Most part of urban areas is covered with concrete surface. Therefore rain water cannot go inside the ground directly. Hence we do some techniques to recharge groundwater. These techniques are costly. We have to apply scientifically researched method to recharge ground water. In rural area, there are lots of surfaces through which rainwater can be used to recharge groundwater. In rural areas we have to control on flowing water which may be wasted. We require hardly wealth to recharge groundwater in this area.

Urban Area

Roof top rain water / storm runoff harvesting through -

1. Recharge Pit
2. Tube well
3. Recharge trench
4. Recharge Well

Rural Area

Rain water harvesting through

1. Gully Plug
2. Gabion Structure
3. Check Dam / Cement Plug
4. Dug well Recharge
5. Contour Bund
6. Percolation Tank
7. Recharge shaft
8. Groundwater Dam / Subsurface Dyke

URBAN AREA

In urban area Rain water which is available from roof of building, road, bridge, pave and unpaved path may be wasted if it is not used. This water obtained from the urban area may be used to recharge ground water using some techniques which are being described below.

1. Harvesting of rainwater collected from roof top of buildings through charge pit :-

The area where permeable soil is at shallow depth can be recharged by rainwater received from roof top of the buildings through making charge pit.

- a) This technique is applicable for the aquifers which are present lower depth and the area of the roof is about 100 square meters.
- b) The dimension of recharge pit is about 20cm by 2m by 3m boulders, pebbles and sands are sprayed at its bottom, middle and upper surface respectively.
- c) The pipe through which rainwater is brought to the charge pit is protected by net so that mud and wastage material cannot go to charge pit.
- d) In regular period the upper part of sand in charge pit should be cleaned.
- e) The pipe connecting the rainwater to charge pit should be constructed in such a way that the first rainwater cannot go in charge pit.

2. Harvesting of rainwater collected from roof top of buildings through recharge trench:-

- a) This recharge trench is applicable for the roof whose area is about 300 square meter and aquifer is found at shallow depth.
- b) It is formed about 1m wide, 1.5m depth and 10 to 20 m long.
- c) Boulders, pebbles and sands are kept at its bottom, middle and top part respectively.
- d) The pipe that is used for carrying rainwater to recharge trench is protected by net so that mud and harmful material could not flowed up to the trench.
- e) There must be an arrangement inside pipe so that the first rainwater may be rejected.
- f) In a regular period the recharge trench must be cleaned.

3. Roof top rain water harvesting through tube wells:-

- a) In localities where the shallow aquifers have dried up and present tube wells are having deeper aquifer, for rainwater harvesting tube wells are used.
- b) PVC pipe of 10 cm diameter is used to collect roof drains. The first min fall is flowed out by making a hole in PVC pipe. After the first rain fall, the hole is closed and all rainwater is collected through the tube well. Water is filtered before entering tube well. The diameter and length of filter is about 15cm and 120 cm respectively.
- c) For larger roof area, a filter pit is provided. The roof rainwater is collected in a chamber located on ground. The chamber is filled with boulder at bottom, gravel in the middle and sand at the top with varying

thickness from 30cm to 50cm. the chamber is separated into two parts. The 2nd part is made empty to collect excess filtered water.

RURAL AREA

In rural area there is much scope for rainwater harvesting. Most of rainwater in rural area is wasted through canal and river. Our agriculture depends on rainwater and ground water mainly. Rain is not certain. Sometime there is flood and sometime there is dry. In case of dry agriculture fully depends on groundwater. In this situation groundwater is over exploited. But using rainwater harvesting, these havoc situations can be overcome. There is large scope for rainwater harvesting in rural area than the urban area. Following techniques may be applied for rainwater harvesting in rural area.

1. Rainwater harvesting through gully plug:-

- a) Gully plugs are formed with the help of local stones, clays and bushes.
- b) It is used as an obstacle in the path of water flow in hilly area.
- c) It helps in reducing soil erosion and maintaining soil moisture.
- d) It is constructed there where slope ends so that large amount of water may be collected.

2. Rainwater harvesting through contour bund:-

- a) It is used to maintain soil moisture for long time.
- b) It is useful area where there is low rainwater.
- c) We keep adequate distance between two successive contour bunds so that the water cannot achieve sufficient velocity to damage soil.
- d) For poor aquifer we keep longer distance between two contour bunds.
- e) This is applicable for that area where steps cannot be formed.
- f) The area whose slope is very low is used for rainwater harvesting by this method.

3. Rain water harvesting through gabion structure:-

- a) This is dam which is commonly constructed across small streams to conserve stream with no submergence beyond stream course.
- b) A small bund across the stream is constructed by putting locally available boulders.
- c) The height of such structures is around 50cm and is generally used in the streams with width not more than 10m.
- d) Excess water over flows from this structure.

4. Rainwater harvesting through percolation tank:-

- a) Percolation tank is artificial surface water body.
- b) We prefer it to construct on 2nd and 3rd order stream, located on mostly fractured and weathered rocks which have lateral downstream.
- c) The recharged area downstream should have sufficient number of wells and cultivable land to benefit from the augmented ground water.
- d) In general it is constructed to have a capacity of 0.1 to 0.5 MCM. It is constructed to provide water in column 3 to 4.5m.
- e) Our purpose to construct it is to recharge groundwater storage and hence seepage within the seat of the bed permissible.

5. Rain water harvesting through recharge shaft:-

- a) This is most effective and cheap technique to for recharging groundwater.

- b) The diameter of Recharge dug is kept more than 2m. It is manually dug.
- c) The end of the shaft should be kept at more permeable strata. But it may not touch water table.
- d) The shaft should be filled with boulders, gravel and sand from bottom to top respectively.
- e) This artificial structure is more applicable for village ponds where there is thin layer of clay above the aquifer.
- f) The diameter of the shaft is kept 0.5 to 3m and its height is maintained from 10 to 15m. The upper part of the shaft is kept above the tank bed level.
- g) About 50% water is used to recharge groundwater by this structure.

CONCLUSION:

Rain water harvesting is the demand of our country not only for saving lives but also for developing the country. It helps for developing industries which reduces unemployment and increases GDP of our country. It plays same role in agriculture. About 70% population depends on agriculture, and agriculture depends on groundwater and rainwater mainly. It helps us in following way -

- 1 Recharging groundwater is cheaper than the recharging surface water.
- 2 Aquifer behaves like a system which distributes water.
- 3 During groundwater recharging no land and no population are affected.
- 4 Groundwater can neither be evaporated not be polluted directly.
- 5 Recharging groundwater favors environment.
- 6 It makes aquifer enrich in productivity.
- 7 It helps in increasing groundwater level.
- 8 It decreases chances of famine.
- 9 It also helps in reducing soil erosion.

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